



## A Guild for Monitoring and Evaluating Fish Communities in Bottomland Hardwood Wetlands

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**PURPOSE:** Documentation and ecological classification of fishes found in flooded wetlands are necessary to establish guidelines for evaluation and protection of these habitats. This paper summarizes adult and larval fish collections in the Rex Hancock/Black Swamp Wildlife Management Area, Cache River system, Arkansas, and classifies the fish community according to habitat preferences and modes of reproduction into a reproductive guild of fishes. This guild can serve as a basis in the selection of and evaluation of fish species for monitoring studies.

**BACKGROUND:** The Cache River originates just north of the Arkansas-Missouri state line and is part of the White River drainage. The basin covers approximately 2,018 square miles and is 143 miles long with a maximum width of 18 miles. The river flows 203 miles to its confluence with the White River near Clarendon, Arkansas. The river meanders across the floodplain, creating numerous cutoffs and side channels. In the vicinity of the study area, the forested floodplain ranges from 1 to 2 miles in width. Extensive areas of cypress-tupelo occur. As with many southeastern streams, flooding occurs by lateral expansion of the river onto the floodplain (Ross and Baker 1983). Flooding typically occurs from late February through May with intervening periods of drought and inundation of the floodplain. Water depths on the floodplain range from a few inches to more than 5 ft.

Fishes were collected from 1987 through 1989 in the river channel and floodplain of a fourth order reach of the Cache River. Four types of gear were used to sample juvenile and adult fishes: gill nets, hoop nets, seines, and a boat electroshocker. Larval fish were sampled regularly with three gears: tow net, light trap, and diaphragm pump.

**COMPOSITION OF THE FISH COMMUNITY:** The fish community consists of 71 species (Table 1), taxonomically dominated by minnows (16 species), sunfishes (15 species), darters (9 species), catfish (7 species), and suckers (6 species). Fishes of the Cache River are composed of a mixture of flood-exploitative species (i.e., those that exploit floodplain habitats) and flood-quiescent species (i.e., those that do not exploit floodplain habitats) whose movements may be influenced by hydrological factors such as turbidity and habitat availability (Ross and Baker 1983). Flood-exploitative species include blacktail shiner, grass pickerel, pirate perch, weed shiner, bluegill, green sunfish, blackspotted topminnows, and some darters; flood-quiescent species include longear sunfish, freshwater drum, and many darters. Other species characteristic of backwater habitats were also collected including pirate perch, flier, banded pygmy sunfish, and bantam sunfish. Species composition was typical of large, alluvial rivers in the lower Mississippi River basin (Cross, Mayden, and Stewart 1986).

**DEVELOPMENT OF GUILD:** A guild is a group of species that exploits the same environmental resources (e.g., habitats) in similar ways (Root 1967). Therefore, all members of a guild should be affected by the alteration of those resources (Roberts and O'Neil 1985). The Cache River guild of fishes is based on habitat preference and reproductive mode of adults. These criteria were used because water velocity and access to backwaters are directly modified by water resource projects, and the objective of many wetland restoration/creation projects is to provide spawning and rearing areas. Many bottomland hardwood fish species have specialized habitat requirements (Meffe and Sheldon 1988), so that changes in water velocity or access to backwaters could substantially impact populations. Most fishes have

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>JAN 1992</b>		2. REPORT TYPE		3. DATES COVERED -	
4. TITLE AND SUBTITLE <b>A Guild for Monitoring and Evaluating Fish Communities in Bottomland Hardwood Wetlands</b>			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Army Engineer Waterways Experiment Station,3909 Halls Ferry Road,Vicksburg,MS,39180-6199</b>			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <b>see report</b>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES <b>7</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

specific requirements for reproduction that are essential for their continued existence. Since reproductive failure in response to environmental stress can result in the rapid elimination of fish populations (Donaldson 1990), reproductive modes should be considered in evaluation of fish communities.

**HABITAT CATEGORIES:** A habitat classification of riverine systems by Baker, Killgore, and Kasul (1991) was used to define three distinct habitats in bottomland hardwood wetlands according to the position and size of the habitat, and the presence of flowing water. These are:

- Lentic-Oxbow Lakes, which are nonflowing habitats that include sloughs and oxbow lakes. They are permanent, floodplain waterbodies that are usually remnants of abandoned river channels. Most become contiguous with the main channel during floods. Size varies, ranging from several surface acres to greater than 500 acres. Large lakes are much deeper with a lower surface-to-volume ratio than floodplain ponds.
- Lentic-Floodplain Ponds, which are permanent floodplain ponds, but relatively shallow, isolated bodies of water. They form in floodways, in low points in intermittent tributaries, or in backswamp depressions. They are usually associated with cypress-tupelo stands. Ponds are usually less than one-tenth acre, less than 6 ft deep, with deep muddy substrates.
- Lotic-Channels, or flowing waterbodies, typically have sandbars and secondary channels. The substrate of these channels is usually sand with detritus deposited in the slackwater margins. Their depths and velocities are variable depending on channel morphology and instream cover.

**REPRODUCTIVE MODES:** Balon (1984) developed an evolutionary classification of reproductive modes that addressed behavior and substrate selection of fishes. In developing the Cache River Guild, fishes were classified according to four of Balon's (1984) reproductive modes that emphasized different substrates. These four reproductive modes are:

- Pelagophils, which are fishes that are nonguarding, egg-scattering, pelagic (open water) spawners. Eggs either float in the water column or move along the bottom.
- Litho-Psammophils, which are fishes that deposit eggs over sand or gravel. Some species guard the eggs from predators, while others exhibit no guarding behavior.
- Phytophils, which are fishes that deposit eggs on aquatic vegetation or woody debris. Eggs are often adhesive. Both guarding and nonguarding behavior is exhibited by adults.
- Speleophils, which are fishes that place their eggs in crevices, holes, under rocks, or in other types of structure to protect them from predators.

**APPLICATION TO CACHE RIVER GUILD:** Cache river fishes were assigned to one of the habitat categories and reproductive modes, resulting in 12 guilds (Table 2). Approximately 50 percent of the species prefer large, floodplain lakes and usually spawn on sand, gravel, or vegetation. Many of these species are recreationally or commercially important (e.g., bluegill, largemouth bass, smallmouth buffalo). However, most of the species in the lentic-large lake categories can tolerate a wide range of aquatic habitat conditions and are often considered habitat generalists. The most distinctive group of fishes associated with bottomland hardwood wetlands are in the lentic-floodplain pond categories (e.g., taillight shiner, flier, slough darter). There is evidence that some of these species can survive long periods of very low oxygen concentrations, perhaps explaining their dominance in this habitat (Baker, Killgore, and Kasul 1990; Leitman, Darst, and Nordhaus 1991). Species occurring in the lotic-channel category typically reside in areas with current as juveniles and adults, avoid habitats with excessive sedimentation, but often use the inundated floodplain during their larval stages.

**USING THE GUILD FOR MONITORING AND EVALUATING:** The initial step in habitat assessment studies is to identify all species in the study area, and from this list, select representative evaluation species for further analysis. The guild presented in this technical note includes many of the fish species that occur in bottomland hardwood river systems in the southeastern United States but can be revised for individual systems based on local fish surveys and on published life history studies. It can be used to select evaluation species that are most sensitive to particular habitat alterations (e.g. grass pickerel and taillight shiners to reductions in weedy floodplain ponds) and/or to maximize representation of the greatest number of ecologically similar species by choosing those from speciose guilds (e.g. spotted sucker and longear sunfish to represent habitat of 21 species).

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**TABLE 1.** Fish species collected from the channel (C) and floodplain (F) in the Cache River from 1987 through 1989. Juvenile and adult fishes were collected in November 1987, May 1988, July 1988, and May 1989. Larval fishes were sampled on six occasions during the spring of 1988 and 1989. An asterisk denotes species that were rarely collected (i.e., less than 10 individuals collected during the study).

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(Continued)

**TABLE 1.** (Continued)

Family and Species	Juvenile/Adult		Larvae	
	C	F	C	F
Catostomidae				
River carpsucker ( <i>Carpiodes carpio</i> )	X		X	X
Quillback ( <i>C. cyprinus</i> )*	X			
Smallmouth buffalo ( <i>Ictiobus bubalus</i> )	X	X		X
Bigmouth buffalo ( <i>I. cyprinellus</i> )	X			
Black buffalo ( <i>I. niger</i> )*	X	X		
Spotted sucker ( <i>Minytrema melanops</i> )	X	X	X	
Ictaluridae				
Black bullhead ( <i>Ameiurus melas</i> )*		X		
Yellow bullhead ( <i>A. natalis</i> )	X	X		X
Blue catfish ( <i>Ictalurus furcatus</i> )*	X			
Channel catfish ( <i>I. punctatus</i> )	X	X	X	X
Tadpole madtom ( <i>N. gyrinus</i> )	X	X	X	X
Freckled madtom ( <i>N. nocturnus</i> )*	X			
Flathead catfish ( <i>Pylodictis olivaris</i> )	X			
Aphredoderidae				
Pirate perch ( <i>Aphredoderus sayanus</i> )		X	X	X
Cyprinodontidae				
Blackspotted topminnow ( <i>F. olivaceus</i> )		X	X	X
Northern starhead topminnow ( <i>F. dispar</i> )*			X	
Poeciliidae				
Mosquitofish ( <i>Gambusia affinis</i> )		X		
Atherinidae				
Brook silverside ( <i>Labidesthes sicculus</i> )	X	X		
Inland silverside ( <i>Menidia beryllina</i> )	X	X		
Percichthyidae				
White bass ( <i>Morone chrysops</i> )	X			
Yellow bass ( <i>M. mississippiensis</i> )*	X			

(Continued)

**TABLE 1.** (Concluded)

Family and Species	Juvenile/Adult		Larvae	
	C	F	C	F
Centrarchidae				
Flier ( <i>Centrarchus macropterus</i> )		X		X
Banded pygmy sunfish ( <i>Elassoma zonatum</i> )		X	X	X
Warmouth ( <i>L. gulosus</i> )	X	X		
Orangespotted sunfish ( <i>L. humilis</i> )		X		
Green sunfish ( <i>Lepomis cyanellus</i> )	X	X		
Bluegill ( <i>L. macrochirus</i> )	X	X		X
Dollar sunfish ( <i>L. marginatus</i> )		X		
Longear sunfish ( <i>L. megalotis</i> )	X	X		
Redear sunfish ( <i>L. microlophus</i> )	X	X		
Spotted sunfish ( <i>L. punctatus</i> )*		X		
Bantam sunfish ( <i>L. symmetricus</i> )		X		
Largemouth bass ( <i>Micropterus salmoides</i> )	X	X		
Spotted bass ( <i>M. punctulatus</i> )	X	X		
White crappie ( <i>Pomoxis annularis</i> )	X	X	X	X
Black crappie ( <i>P. nigromaculatus</i> )*	X			X
Percidae				
Mud darter ( <i>Etheostoma asprigene</i> )		X	X	X
Bluntnose darter ( <i>E. chlorosomum</i> )		X	X	X
Swamp darter ( <i>E. fusiforme</i> )		X		
Slough darter ( <i>E. gracile</i> )		X		X
Harlequin darter ( <i>E. histrio</i> )*	X			
Cypress darter ( <i>E. proeliare</i> )		X	X	X
Speckled darter ( <i>E. stigmaeum</i> )	X	X	X	X
Logperch ( <i>Percina caprodes</i> )	X	X		X
River darter ( <i>P. shumardi</i> )	X		X	X
Sciaenidae				
Freshwater drum ( <i>Aplodinotus grunniens</i> )	X	X	X	
<b>TOTAL NUMBER OF SPECIES</b>	<b>52</b>	<b>54</b>	<b>23</b>	<b>24</b>

**TABLE 2.** Guild of adult fishes occurring in bottomland hardwood wetlands. Species designations are based on Cache River collections and other literature cited in the text.

Reproductive Mode	Wetland Habitat		
	Lentic-Oxbow Lakes	Lentic-Floodplain Ponds	Lotic-Channels
<b>Pelagophils</b>	Gizzard shad Threadfin shad Silvery minnow Ribbon shiner	Mosquitofish Cypress minnow	American eel Speckled chub Silver chub Emerald shiner Mimic shiner Freshwater drum
<b>Litho-Psammophils</b>	River carpsucker Quillback Spotted sucker Warmouth Orangespotted sunfish Bluegill Redear sunfish Largemouth bass Spotted bass White crappie Black crappie	Pugnose minnow Spotted sunfish Bantam sunfish Flier Green sunfish Dollar sunfish Mud darter Bluntnose darter	Chestnut lamprey Silverband shiner Steelcolor shiner White bass Yellow bass Longear sunfish Harlequin darter Speckled darter Logperch River darter
<b>Phytophils</b>	Spotted gar Shortnose gar Bowfin Common carp Golden shiner Smallmouth buffalo Bigmouth buffalo Brook silverside	Grass pickerel Taillight shiner Northern starhead topminnow Blackspotted topminnow Banded pygmy sunfish Swamp darter Slough darter	Longnose gar Weed shiner Black buffalo Inland silverside
<b>Speleophils</b>	Bullhead minnow Black bullhead Yellow bullhead Channel catfish Tadpole madtom Flathead catfish	Pirate perch Cypress darter	Flacktail shiner Blue catfish Freckled madtom